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PATENT APPLICATION

Emergency Shelter Structure

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Emergency Shelter Structure

BACKGROUND OF THE INVENTION

This invention relates to flexible shelter structures such as tents and the like.

Numerous flexible shelter and tent structures are described in the prior art. For example, various convex multi-poled tent structures are described in U.S. Patent Nos. 3,986,519, 4,099,533, 4,265,260, 4,414,993, and 6,145,527, all of which are owned by the inventor of the present invention. U.S. Patent Nos. 3,986,519 and 4,099,533 both disclose dome-like structures composed of a plurality of flexible pole or rod elements maintained under tension in a generally arcuate shape, and an underlying membrane. Each structure includes at least two intersecting sets of such pole or rod elements. The rod or pole elements are held in fixed relationship at intersections by fittings secured to the underlying flexible membrane or sheath. The underlying membrane or sheath acts as a tension member to maintain the poles under tension.

U.S. Patent Nos. 4,265,260 and 4,414,993 disclose a flexible vault structure which similarly includes a plurality of flexible resilient poles that are held under tension in generally arcuate shape by an underlying fabric member. U.S. Patent No. 4,265,260 discloses the use of fabric sleeves in addition to fittings for coupling the poles to the underlying fabric member.

U.S. Patent No. 6,145,527 discloses a dome style shelter structure having a plurality of tension members or a tension web associated with the poles in order to provide further tension force on the poles and further rigidity to the overall structure. Each tension member or web associated with a pole is connected to the pole at spaced locations along the pole's length. The tension members or web further tension the poles in their own planes.

The foregoing shelter structures tend to find use primarily for recreational purposes such as camping, backpacking, and the like. There remains a need for exceptionally strong, temporary shelter structures that can be manufactured at relatively low cost, that use common and easily obtained materials, that can withstand extreme and varying weather conditions over extended periods of time, and that can be made large enough to accommodate entire families if need be. For example, in times of hurricane, flood, and other environmental

disasters, entire families may be displaced from their homes. Emergency relief and aid organizations often are challenged to find suitable shelter for such victims, particular shelters that can withstand extreme conditions, and that can be used over extended periods of time while permanent structures are repaired or rebuilt. The present invention addresses these needs.

BRIEF SUMMARY OF THE INVENTION

The present invention resides in a shelter structure which has a plurality of poles arranged in intersecting relationship and forming a plurality of pole crossings to form a frame. The frame has one or more four sided openings, each such opening having pole crossings as vertices and sections of said poles as sides thereof. Each of the poles has a first terminal end and a second terminal end, and each of the poles assumes a substantially arcuate shape under tension with its first and second terminal ends terminating in a common plane, such as the ground, to thereby define an interior volume. One or more tension harnesses are connected between diagonal vertices of at least one four-sided opening, and preferably each four-sided opening. This results in an exceptionally rigid and strong frame. A covering is connected to at least some of the poles to substantially shelter the interior volume defined by the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a preferred frame for a shelter structure embodying the present invention.

Figure 2 is a top plan view of a portion of the frame of Figure 1 showing one form of tension harness according to the present invention.

Figure 3 is a top plan view of a portion of the frame of Figure 1 showing another form of tension harness according to the present invention.

Figure 4 is a perspective view of a preferred shelter structure according to the present invention and employing a form of tension harness integral with a covering.

Figure 5 is a top plan view of the shelter structure of Figure 4.

DETAILED DESCRIPTION OF THE INVENTION

Presently preferred embodiments of the invention will now be described in detail with reference to the drawings, wherein similar parts are identified by like reference numerals.

Figure 1 illustrates a frame for a presently preferred form of shelter structure according to the invention. The frame 10 is formed by a plurality of flexible, resilient elongated poles 20, which are arranged in an intersecting pattern and which form a plurality of pole crossings 25. The poles 20 have opposite first and second terminal ends 20a, 20b, which terminate in a common plane 30, such as the ground or a base.

Under tension, the poles 20 flex in a generally arcuate shape, thereby defining a substantially dome-shaped frame having an interior volume 35. In the particular embodiment shown in Figure 1, the terminal ends of three poles extending in a first direction are bound together and secured to the ground at 40 and 42, and the terminal ends of three other poles crossing in a second generally orthogonal direction are bound together and secured to the common plane at 44 and 46. In this particular configuration, the terminal ends of the poles may be bound by conventional means such as bungee cords, cable ties, or tape. The terminal ends may be secured to the common plane by any suitable means, including tent stakes for example. In addition, it may be desirable to interconnect the poles at one or more of the pole crossing locations. This also is suitably accomplished using conventional means such as bungee cords, cable ties, or tape.

The poles themselves may be formed of any suitable flexible, resilient material. Many such materials are known to those skilled in the art. A particularly preferred material for use in larger shelters which can be used in emergency situations is PVC pipe. PVC pipe is readily available, flexible, resilient, and strong. It is also relatively inexpensive, light, and stands up well to adverse elements. It may also be used for other purposes when no longer needed for the shelter structure.

Referring to Figures 2 and 3, it is seen that the intersecting arrangement of the poles creates a number of four-sided openings in the frame, in this particular embodiment four such openings 50, 51, 52, and 53. Also, in this particular embodiment, the openings are not substantially square or rectangular but are more approximately diamond-shaped. This is due to the relative angles of the crossing poles to each other, due to binding their terminal ends together. However, in other embodiments where the terminal ends of the poles are not bound together, but where they are spaced about the common plane, the openings may approximate more perfect squares or rectangles. The invention is of course equally applicable to both configurations.

Each of the four-sided openings has four vertices corresponding to pole crossing locations. The four sides of the openings correspond to sections of the crossing poles.

A key feature of the invention is the provision of one or more tension harnesses 60, which provide exceptional strength and stability to the frame and hence the shelter structure. As shown most clearly in Figures 2 and 3, tension harnesses are preferably connected between the diagonal vertices of at least the openings themselves, and preferably between the diagonal vertices of adjacent openings as well. Figure 2 illustrates a first preferred form of tension harness in which only one set of vertices of each opening and adjacent opening are interconnected. In this form, the tension harness has two portions 60a and 60b, which are approximately orthogonal to each other. Figure 3 illustrates another preferred form of tension harness in which all of the diagonal vertices of all adjacent openings are interconnected. In this form, additional tension harness portions 60c, 60d, 60e, and 60f interconnect the remaining diagonal vertices of the adjacent openings with portions 60c and 60e being orthogonal to portion 60a, and portions 60d and 60f being orthogonal to portion 60b. In this form, the diagonal vertices of each opening are essentially interconnected by a criss-crossing tension harness.

By having a tension harness interconnect the diagonal vertices of one or more openings, forces from external sources, such as the elements are resisted by the structure, regardless of the direction of the forces. For example, without the provision of a tension harness, forces acting upon the side of the structure can cause the poles to compress and deform the shapes of the openings, and therefore the structure. Severe enough forces can cause the poles and the structure to fail. The tension harness resists external forces from all directions. For example, forces from one direction "A" will be resisted by harness portions perpendicular to "A" (60b), whereas forces from the orthogonal direction will be resisted by harness portions 60a. Forces at an angle to and not in parallel with any harness portions will be resisted by all harness portions in proportion to the angle of the force to the harness portion.

The tension harness may be constructed of individual cords or strips or an integral or interconnected set of cords or strips. Preferably the tension harness is constructed of a low stretch material such as polypropylene or high density polyethylene. The tension harness may be connected to the pole crossings by any means suitable to provide a relatively secure connection, including Grip Clips™, "S" hooks, or cord. As shown best in Figure, 1, the tension harness may extend to the common plane at one or more points and be secured there by conventional means, including tent stakes, for example.

Referring to Figures 4 and 5, to complete the shelter structure a membrane or covering 65 may be draped over the frame and secured to the frame and to the common plane

to shelter the interior volume. The covering may be secured to the poles of the frame by any suitable means, many such means being well known to persons skilled in the art. One suitable means of attachment is commercially sold as the GripClip (TM) by Shelter Systems of Menlo Park, California. Others are shown and described in various patents, including some of those identified previously herein. The covering may also be secured to the common plane by any suitable means, many such means being known to persons skilled in the art, including for example, cords, rings, and tent stakes. Thus, for example, in the embodiment of Figures 4 and 5, the covering may be attached to the frame at multiple points 70 at or in the vicinity of pole crossing locations. The covering may be secured to the common plane using stakes 75 at multiple locations 80 around the periphery of the frame. Alternatively, if desired, the membrane or covering may be suspended from the frame rather than covering it.

The membrane or covering may be any suitable material that is relatively impervious to the elements, many such materials being known to persons skilled in the art. A particularly preferred material is laminated and woven high density polyethylene sheet. This material is strong, relatively impervious to the elements, readily available and relatively inexpensive.

As an alternative to the forms of tension harness previously described, it may be desirable to integrally form the tension harness and the covering. This can be done by employing a covering material that is itself a low stretch material, at least in the portions overlying the four-sided frame openings, and securely attaching the covering to the diagonal vertices of the four-sided openings at or in the vicinity of the pole-crossing locations. Alternatively or additionally, reinforced seams, bands, or the like may be provided in the covering to overly and extend between the diagonal vertices of the four-sided openings, with the covering being attached there as described. This arrangement creates tension lines between the vertices without requiring separate tension harness elements. Of course, both can be used simultaneously as well.

The present invention has been described herein with reference to particular presently preferred embodiments thereof. However, those skilled in the art will appreciate that a variety of modifications, changes, and substitutions may be made while retaining the features and advantages of the invention and without departing from its spirit. For example, various modifications may be made in materials, shapes and sizes of various components. Further, depending upon the desired shape, volume and usage of the flexible structure being constructed, greater or fewer poles may be used and the arrangement and configurations of the poles may be modified to construct flexible shelter structures having various shapes.

Accordingly, it is intended that the invention not be limited to the particular embodiments disclosed, but that it include all embodiments and equivalents falling within the scope of the appended claims.